

WHAT IS CLAIMED IS:

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1. An implantable hearing device comprising:
a transducer which produces vibrations in response
to an electrical signal; and
a connecting member having a first end connected to
the transducer and a second end connectable to a component of
a human ear, wherein the transducer and the component of a
human ear are elastically coupled by the connecting member.

2. The apparatus of claim 1, wherein said
connecting member comprises a resilient biasing mechanism.

3. The apparatus of claim 1, wherein said
connecting member comprises a urethane strip.

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4. An implantable hearing device, which is coupled
between a tympanic membrane and an oval window of an ear of a
human subject, comprising:

an amplifier;

a first transducer electrically coupled to said
amplifier for converting mechanical vibrations to electrical
signals;

a second transducer electrically coupled to said
amplifier for converting electrical signals to mechanical
vibrations;

a first connecting member having a first end
connected to the first transducer and a second end connected
to the tympanic membrane, wherein said first transducer and
said tympanic membrane are elastically coupled by said first
connecting member;

a second connecting member having a first end
connected to said second transducer and a second end connected
to said oval window, wherein said second transducer and said
oval window are elastically coupled by said second connecting
member.

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4.
5. The apparatus of claim 3, wherein said first
connecting member creates a tensile force between the tympanic
membrane to said first transducer when coupled therebetween.

5.
6. The apparatus of claim 3, wherein said second
connecting member creates a tensile force between said second
transducer to the oval window when coupled therebetween.

7. The apparatus of claim 4, wherein said first
and said second connecting members each comprise a resilient
biasing mechanism.

8. The apparatus of claim 4, wherein said first
and said second connecting members each comprise a urethane
strip.

9. The apparatus of claim 4, wherein said first
and said second connecting members each comprise at least one
set of angled bends.

10. An implantable hearing device connectable to a
component of an ear of a human subject, comprising:
a hearing device for improving hearing of the human
subject; and
means for elastically coupling said hearing device
to the component of the ear.

11. The apparatus of claim 10, wherein said means
for elastically coupling creates a tensile force between said
implantable hearing device and the component of the ear.

12. The apparatus of claim 10, wherein said means
comprises a resilient biasing mechanism.

13. The apparatus of claim 10, wherein said means
comprises a urethane strip.

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3 14. A method of improving hearing in a human
4 subject comprising:

5 implanting an implantable hearing device into a
6 mastoid bone of the human subject; and

7 elastically coupling said implantable hearing device
8 to a vibratory component of the ear using a connecting member.

1 15. A method of improving hearing in a human
2 subject, an ear of the human subject having a tympanic
3 membrane and an oval window, comprising:

4 implanting an implantable hearing device in a
5 mastoid bone of the human subject, said implantable hearing
6 device comprising

7 (a) an amplifier,

8 (b) a first transducer electrically coupled to
9 said amplifier, and

10 (c) a second transducer electrically coupled
11 to said amplifier;

12 elastically coupling the tympanic membrane and said
13 first transducer using a first compliant connecting member;
14 and

15 elastically coupling said second transducer and the
16 oval window using a second compliant connecting member.

1 16. A method of manufacturing a hearing device,
2 comprising:

3 providing an amplifier;

4 electrically coupling a first transducer to said
5 amplifier;

6 electrically coupling a second transducer to said
7 amplifier;

8 mechanically coupling a first compliant connecting
9 member to said first transducer; and

10 mechanically coupling a second compliant connecting
11 member to said second transducer.

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1 17. The method of claim 16, wherein said first and
2 said second compliant connecting members each create a tensive
3 force.

1 18. The method of claim 16, wherein said first and
2 said second compliant connecting members each comprise a
3 spring.

1 19. The method of claim 16, wherein said first and
2 said second compliant connecting members each comprise a
3 urethane strip.

1 20. In an implantable hearing device of the type
2 coupled to a component of an ear of a human subject, the
3 improvement comprising:

4 a connecting member adapted to elastically couple
5 the implantable hearing device to the component of the ear.

1 21. In an implantable hearing device adapted to be
2 coupled between a tympanic membrane and an oval window of an
3 ear of a human subject and having an amplifier, a first
4 transducer electrically coupled to the amplifier, and a second
5 transducer electrically coupled to the amplifier, the
6 improvement comprising:

7 a first connecting member adapted to elastically
8 couple the tympanic membrane to said first transducer; and

9 a second connecting member adapted to elastically
10 couple said second transducer to the oval window.

1 22. In an implantable hearing device adapted to
2 being coupled to a component of the middle ear of a human
3 subject, comprising an electromagnetic unit having a
4 diaphragm, the improvement comprising:

5 a connecting member adapted to elastically couple a
6 component of the middle ear to said diaphragm.

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^{13.}
~~23.~~ The improved hearing device of claim ^{12,}~~22,~~
wherein the connecting member is adapted to be coupled to the
diaphragm and the structure of the middle ear using magnetism.

^{14.}
~~24.~~ The improved hearing device of claim ^{12,}~~22,~~
wherein the implantable device is hermetically sealed.

^{15.}
~~25.~~ An implantable hearing device of the type
coupled to one or more ossicles of an inner ear of a human
subject, comprising:
a housing;
an electromagnetic unit having a magnet disposed
inside said housing and a coil surrounding a portion of said
housing;
a diaphragm mechanically coupled to said
electromagnetic unit, wherein motion of the diaphragm is
proportional to a signal applied to said electromagnetic unit;
and
a connecting member adapted to elastically couple
said diaphragm to the one or more ossicles of the human ear.

^{16.}
~~26.~~ The improved hearing device of claim ^{15,}~~25,~~
wherein the implantable hearing device is hermetically sealed.

^{17.}
~~27.~~ A method of improving hearing in a human
subject, an ear of the human subject having a middle ear
structure, comprising:
implanting an implantable hearing device in a
mastoid bone of the human subject, said implantable hearing
device comprising:
an electromagnetic unit having a diaphragm
mechanically driven by said electromagnetic unit; and
elastically coupling said diaphragm and a component
of the middle ear structure using a first connecting member.

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1 28. The method of claim ~~27~~¹⁷, wherein the implantable
2 hearing device is hermetically sealed.

1 29. A method of manufacturing a hearing device,
2 comprising:
3 providing an electromagnetic unit comprising:
4 a housing;
5 a magnet disposed inside said housing;
6 a coil surrounding a portion of said housing
7 a diaphragm mechanically coupled to said
8 magnet, wherein motion of the diaphragm is substantially
9 proportional to a signal applied to said electromagnetic unit;
10 and
11 mechanically coupling a connecting member to said
12 diaphragm.

1 30. The method of claim 29, further comprising
2 encapsulating the electromagnetic unit such that the
3 electromagnetic unit is hermetically sealed.

1 19.
2 31. An implantable hearing device adapted to being
3 coupled to one or more ossicles of an inner ear of a human
4 subject, comprising:
5 a coil;
6 a compliant connecting member adapted to elastically
7 couple said coil to a magnet, the magnet being coupled to the
one or more ossicles of the human ear.

1 20.
2 32. The hearing device of claim ~~31~~¹⁹, wherein the
3 compliant connecting member comprises a keeper/spring device.

1 21.
2 33. A method of improving hearing in a human
3 subject, an ear of the human subject having a middle ear
4 structure, comprising:
5 implanting a magnet on a component of the middle ear
structure;

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6 elastically coupling the magnet to a first portion
7 of a connecting member; and

8 elastically coupling a coil device to a second
9 portion of said connecting member.

1 ²²
2 ~~34~~. The method of claim ²¹~~33~~, wherein the connecting
member comprises a keeper/spring device.

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